

# इंटरनेट

# मानक

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 9000-21 (1985): Basic environmental testing procedures for electronic, electrical items, Part 21: Acoustics noise test [LITD 1: Environmental Testing Procedure]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



IS : 9000 ( Part 21 ) - 1985

*Indian Standard*

**BASIC ENVIRONMENTAL TESTING  
PROCEDURES FOR ELECTRONIC AND  
ELECTRICAL ITEMS**

**PART 21 ACOUSTIC NOISE TEST**

UDC 621.38.038 + 621.31 : 621.317.39 : 534.836.2



© Copyright 1986

**INDIAN STANDARDS INSTITUTION**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

*Indian Standard*

# BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

## PART 21 ACOUSTIC NOISE TEST

Environmental Testing Procedures Sectional Committee, LTDC 2

*Chairman*

LT-GEN D. SWAROOP ( RETD )  
89 Munirka Enclave, New Delhi

*Members*

*Representing*

WG-CDR A. K. DHINGRA	Instrumentation Ltd, Kota
SHRI A. P. GUPTA ( <i>Alternate</i> )	
BRIG R. C. DHINGRA ( RETD )	Electronics Regional Test Laboratory ( North ), New Delhi
SHRI K. C. CHHABRA ( <i>Alternate</i> )	
DR P. K. DUTTA	Peico Electronics & Electricals Ltd, Bombay
SHRI V. NARAYANAN ( <i>Alternate</i> )	
SHRI GHASITA SINGH	Central Electronics Engineering Research Institute ( CSIR ), Pilani
SHRI B. P. GHOSH	National Test House, Calcutta
SHRI B. C. MUKHERJEE ( <i>Alternate</i> )	
SHRI G. R. GHOSH	Society of Environmental Engineers, Bangalore
SHRI T. C. GOSALIA	The National Radio & Electronics Co Ltd, Bombay
JOINT DIRECTOR STANDARDS ( S & T )/TESTS, RDSO	Research, Designs & Standards Organization ( Ministry of Railways ), Lucknow
JOINT DIRECTOR STANDARDS ( S & T )/LAB, RDSO ( <i>Alternate</i> )	
BRIG L. G. KETKAR	Ministry of Defence ( DGI ), Bangalore
SHRI B. RAGHVENDRA RAO ( <i>Alternate</i> )	
SHRI S. P. KULKARNI	Radio Electronics & Television Manufacturers' Association, Bombay
DR P. K. DUTTA ( <i>Alternate</i> )	
SHRI I. C. MATHUR	Directorate of Technical Development & Production ( Air ) ( Ministry of Defence ),
SQN-LDR K. N. SAMPATH KUMAR ( <i>Alternate</i> )	
SHRI H. V. MEHTA	Posts and Telegraphs Board, New Delhi
SHRI T. S. VASUDEVAN ( <i>Alternate</i> )	

( Continued on page 2 )

© Copyright 1986

INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

( Continued from page 1 )

<i>Members</i>	<i>Representing</i>
SHRI K. R. ANANDAKUMARAN NAIR	Lucas-TVS Limited, Madras
SHRI C. RANGANATHAN ( <i>Alternate</i> )	
SHRI D. V. PETKAR	Bhabha Atomic Research Centre, Trombay, Bombay
SHRI JAGDISH LAL ( <i>Alternate</i> )	
SHRI P. S. K. PRASAD	Bharat Electronics Ltd, Bangalore
SHRI D. S. GOPALAKRISHNA ( <i>Alternate</i> )	
SHRI V. RAMARAO	Electronics Corporation of India Ltd, Hyderabad
SHRI T. D. VEERVANI ( <i>Alternate</i> )	
SHRI P. V. RAO	Indian Telephone Industries Ltd, Bangalore
SHRI LAKSHMINARAYANA ( <i>Alternate</i> )	
SHRI P. K. SAMA	Bharat Heavy Electricals Ltd, Bhopal
DR O. P. CHHABRA ( <i>Alternate I</i> )	
SHRI B. K. MAHAJAN ( <i>Alternate II</i> )	
SHRI P. K. SHUKLA	Ministry of Defence ( R & D ), Bangalore
SHRI G. S. PAI ( <i>Alternate</i> )	
SHRI K. K. TANEJA	Directorate General of Technical Development, New Delhi
SHRI H. S. DUBEY ( <i>Alternate</i> )	
DR R. C. TRIPATHI	Department of Electronics, New Delhi
DR A. K. JAIN ( <i>Alternate</i> )	
SHRI H. C. VERMA	All India Instrument Manufacturers' & Dealers' Association, Bombay
DEPUTY SECRETARY, IMDA ( <i>Alternate</i> )	
SHRI N. SRINIVASAN, Director ( Electronics )	Director General, ISI ( <i>Ex-officio Member</i> )

*Secretary*

SHRI HARCHARAN SINGH  
Joint Director ( Electronics ), ISI

**Panel for Mechanical Tests, LTDC 2 : P8**

*Convener*

SHRI P. K. SHUKLA                      Ministry of Defence ( R & D ), Bangalore

*Members*

SHRI B. M. DALI ( <i>Alternate to</i> Shri P. K. Shukla )	
SHRI K. C. CHHABRA	Electronics Regional Test Laboratory ( North ), New Delhi
SHRI B. B. SHAHA ( <i>Alternate</i> )	
DR P. K. DUTTA	Peico Electronics & Electricals Ltd, Bombay
SHRI V. NARAYANAN ( <i>Alternate</i> )	
SHRI D. S. GOPALAKRISHNA	Bharat Electronics Ltd, Bangalore
LT-COL G. R. MALHAN	Ministry of Defence ( DGI ), Bangalore
LT-COL AMARJIT SINGH ( <i>Alternate</i> )	
SHRI K. M. MANKAD	Electronics Corporation of India Ltd, Hyderabad
SHRI C. RANGANATHAN	Lucas-TVS Ltd, Madras
SHRI P. V. RAO	Indian Telephone Industries Ltd, Bangalore
SHRI LAKSHMINARAYANA ( <i>Alternate</i> )	
SHRI S. P. THUKRAL	Bhabha Atomic Research Centre, Bombay

## *Indian Standard*

# BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

## PART 21 ACOUSTIC NOISE TEST

### 0. FOREWORD

**0.1** This Indian Standard ( Part 21 ) was adopted by the Indian Standards Institution on 25 July 1985, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

**0.2** The differences in environmental testing procedures for component type items and equipment type items are fast disappearing in the context of technological developments. It is, therefore, felt necessary to have uniform testing procedures wherever possible. This series of standards on environmental testing procedure ( IS : 9000 ) has been prepared with this objective. This is also in line with the principle adopted by IEC/ TC 50 'Environmental testing' in developing unified series of standards on environmental testing procedures by the International Electrotechnical Commission.

**0.3** This standard ( Part 21 ) covers the test procedure for acoustic noise. The guidance details are covered in IS : 9001 ( Part 16 )-1985\*.

**0.4** While preparing this standard, considerable assistance is derived from Test No. 2 of JSS 55555-1977 'Environmental test methods for electronic and electrical equipment' issued by the Ministry of Defence, India.

**0.5** In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

---

### 1. SCOPE

**1.1** This standard ( Part 21 ) deals with the procedure for acoustic noise test for electronic and electrical items as a part of basic environmental testing procedures.

---

\*Guidance for environmental testing: Part 16 Acoustic noise test.

†Rules for rounding off numerical values ( *revised* ).

## 2. TERMINOLOGY

**2.1** For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 ( Part 1 )-1977\* shall apply.

## 3. OBJECT

**3.1** The object of this test is to determine the effects of an acoustic field as produced by aerospace vehicles, vehicle power plants, etc, on electronic and electrical items.

## 4. TEST EQUIPMENT

### 4.1 Test Chamber

**4.1.1** A reverberant chamber shall be used for conducting this test.

**4.1.2** The chamber shall be of such shape and construction as to produce as closely as possible, a diffuse sound field. A chamber for this test is illustrated in Fig. 1.

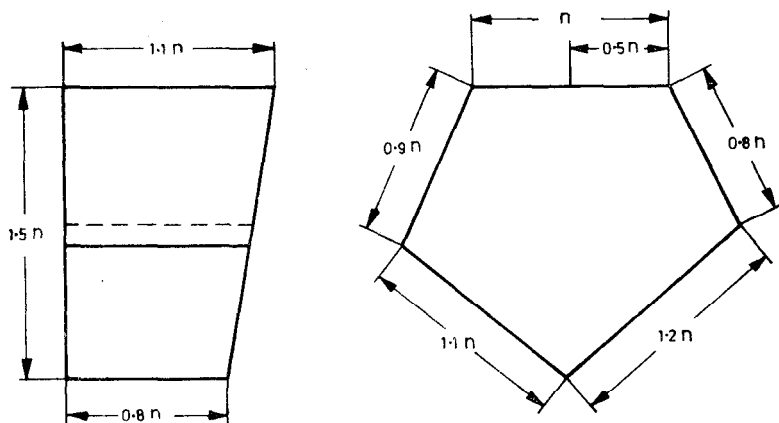


FIG. 1 REVERBERATION TEST CHAMBER SHAPE

**4.1.3** The source opening shall be small in relation to the total wall area. The volume occupied by the equipment under test shall not exceed 10 percent of the volume of the chamber. As far as possible, it shall be possible for the equipment under test to be positioned at the centre of the chamber.

\*Basic environmental testing procedures for electronic and electrical items: Part 1 General.



**4.2 Noise Source** — The acoustic energy supplied to the test chamber should, as far as practicable, be of a random nature approximating to a normal distribution with amplitudes up to a peak value not less than three times the root mean square ( rms ) value.

**4.3 Measuring System** — The measuring and indicating instruments used with the microphones and the microphones themselves shall be capable of handling random noise as specified in 4.2. The measuring system shall give the root mean square value of the sound pressure when measuring a random noise.

**4.4 Microphones** — The microphones used shall be calibrated for random incidence.

**4.5 Spectrum Measurements** — The sound pressure level shall be measured in octave bands with centre frequencies and band widths as required by the relevant specification.

**4.6 Tolerances** — The accuracy of the measuring system shall correspond to the precision grade for sound level meters ( Type 1 meters; see IS : 9779-1981\* ).

## 5. MOUNTING

**5.1** The item shall be mounted in the test chamber in such a manner that all appropriate external surfaces are exposed to the acoustic field. The principal surfaces of the item shall not be parallel to any surface of the test chamber. If the equipment is long compared to its width and a single noise source is used, the equipment shall not be mounted with the long axis in line with the noise source.

**5.2** The item shall be suspended in the chamber on an elastic suspension. The resonant frequency of the suspension system and the equipment combined shall be less than 25 Hz, unless otherwise stated. Care shall be taken to ensure that no spurious acoustic or vibratory inputs are introduced. Where the equipment is provided with specific means of mounting, the suspension system should be attached to these points. Where no specific means of mounting is provided, the suspension system should be connected to the item in such a way that it does not interfere with the free movement of parts of the item which may move independently.

**5.3** If cables, pipes, etc, are required to be connected to the item during the test as specified in the relevant specification, these should be arranged so as to add similar restraints and mass as in the normal installation.

---

\*Specification for sound level meters.

## 6. INITIAL MEASUREMENTS

**6.1** The item shall be visually examined and shall be electrically and mechanically checked as required by the relevant specification.

## 7. CONDITIONING

**7.1** The item shall be subjected to this test in the unpacked and switched off condition and under the laboratory atmospheric conditions.

**7.2** The overall sound pressure level ( SPL ), required by the relevant specification shall be produced in the chamber conforming to the octave band spectra given in Fig. 2. The overall sound pressure levels ( SPL ) corresponding to typical applications are given in Table 1. The relevant specification shall choose one or more of these levels as required.

**NOTE** — With reference to Fig. 2, the optional extension of the frequency spectrum from 125 Hz to 63 Hz ( shown by dotted lines ) involves the assumption that the test chamber has an adequate nodal density at the low frequencies. If the chamber is small, the nodal density may be inadequate to provide a continuous spectrum for the test. The capabilities of the test chamber including the test set up should be examined before specifying the lower frequency limit below 125 Hz.

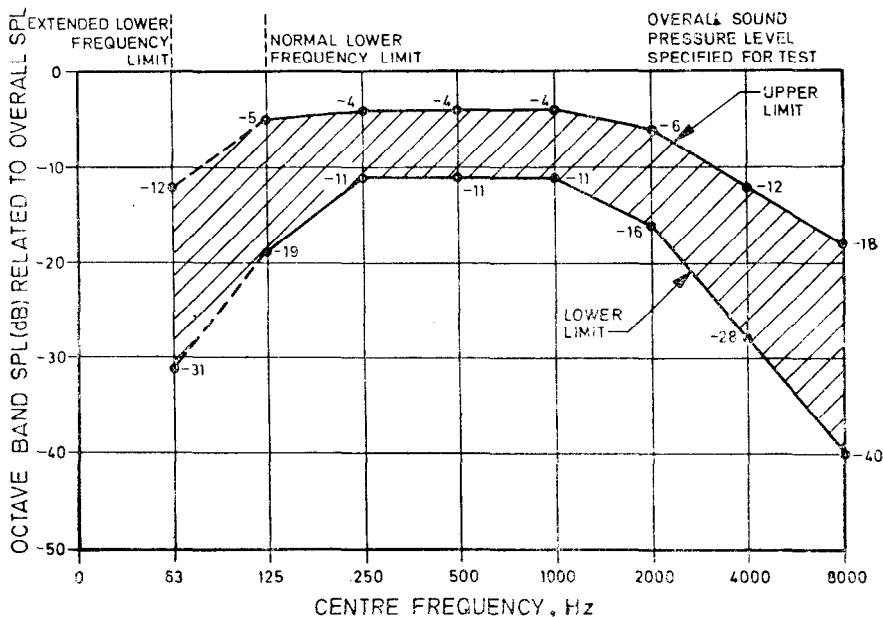


FIG. 2 OCTAVE BAND SPECTRUM

**TABLE 1 OVERALL SOUND PRESSURE LEVELS FOR  
TYPICAL APPLICATIONS**

TYPICAL APPLICATION	SPL dB
Equipment bays of transport aircraft in locations not close to jet exhaust	130
Internal equipment bays of transport aircraft close to jet exhaust. Internal equipment bays remote from jet exhaust of high performance military aircraft	140
Internal equipment bays close to jet exhaust of military aircraft	150
Compartments of missiles close to large thrust motors. Aircraft compartments close to gun muzzles, reheat exhausts	160

**7.3** Measuring equipment capable of resolutions better than one octave may be used but the appropriate reductions should be made to the octave band sound pressure levels in Fig. 2 to give the required overall sound pressure level. Measurements shall be made by using one microphone ( or more if desired ), placed in the area to be occupied by the equipment under test.

**7.4** The item shall be mounted in the chamber as specified in 5 and the overall sound pressure level shall be re-established and monitored by not less than three microphones. A microphone should be located in proximity to each major dissimilar face of the item at a distance of 0.5 m from the face or half the distance to the nearest chamber wall whichever is less. Where the chamber is provided with a single noise source, one microphone shall be placed between the item and the chamber wall farthest from the noise source.

**7.5** The overall sound pressure level ( SPL ) shall be adjusted until the average of the sound level at each of the monitoring points is within + 4 and - 2 dB of the specified level and until the SPL at each monitoring point is also within + 4 and - 2 dB. For larger or irregularly shaped items where it is not practicable to meet the latter requirement, its tolerance may be relaxed to  $\pm 6$  dB. When the spread of readings at the measuring positions does not exceed 5 dB, a simple arithmetical average of the decibel readings may be used. For spread exceeding 5 dB, an rms summation of the individual sound pressures ( not decibel values ) shall be used. The performance achieved shall be noted in the test report.

**7.6** The item shall then be exposed to the above conditions for a period stipulated in the relevant specification.

**NOTE 1** — When testing missiles, the test should be related to the nominal flight time multiplied by a safety factor to be agreed between the contracting parties. In general, a maximum duration not exceeding 30 minutes should suffice. Missiles carried on aircraft may require an additional test simulating the aircraft carriage condition.

**NOTE 2** — Item in aircraft are exposed to acoustic noise environments of varying amplitude during the course of its life. The more severe levels arising during take off and the application of the reheat occur only for a small proportion of the life of the equipment. Lower levels of noise, invariably persist for long periods and the cumulative damage caused by the varying noise environments can, where there is an established relationship between stress and cycles to failure, be simulated by a test of reduced duration applied at a level representative of the most severe conditions. The maximum testing time should not normally exceed 10 hours.

**7.7** The item should be operated either throughout the test or at appropriate phases of the test in a manner representative of the most adverse duty cycles for the item. A demonstration of the functional performance of the item should be made towards the end of the conditioning phase or if desired, at the start and at intervals throughout the conditioning phase.

**NOTE** — If this test is required to assess the survival of the item only, the performance check should be carried out after the noise conditioning.

**7.8** At the conclusion of test under **7.6**, the noise source shall be switched off and the item shall be removed from the chamber.

## **8. RECOVERY**

**8.1** The item shall then be allowed to remain under standard recovery conditions for a period of 2 to 4 hours.

## **9. FINAL MEASUREMENTS**

**9.1** The item shall be visually examined and shall be electrically and mechanically checked as required by the relevant specification.

## **10. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION**

**10.1** When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

- a) Details of spectrum measurements ( *see 4.5* );
- b) Initial measurements ( *see 6* );
- c) The overall sound pressure levels ( *see 7.2* and Table 1 );
- d) Lower frequency limit of the test spectrum, if lower than 125 Hz ( *see 7.2* Note );
- e) The duration of the test ( *see 7.6* );
- f) Details of operations and performance checks and the terms at which they should be made ( *see 7.7* );
- g) Final measurements ( *see 9* ); and
- h) Any deviation from the normal test procedure.